





CHEMICAL ANALYSIS

OF THE

TENNESSEE COLLECTION

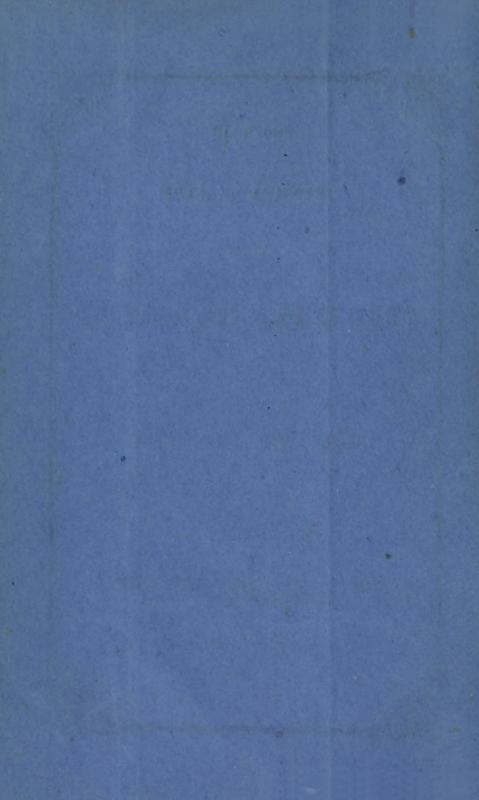
OF

URINARY GALGULI;

BY

E. B. HASKINS, M. D.

A REPORT READ TO THE TENNESSEE MEDICAL SOCIETY IN APRIL 1854, AND PUBLISHED IN THE TRANSACTIONS OF THE SOCIETY.



on the Author

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ERRATA.

On page 5, line 6th., insert of, before chloride. " 32d., for octohedral, read octahedral 6. 66 7. " 17th., for calculous, read calculus. 6.6 8. 4th., for stating points, read starting points. 12, 66 note for potasisum and potasium, read potassium. 66 14. line 2d., for weights, read weight. 4.5 64 17th., for analyses, read analysed. 66 3d & 6th., for earthy phosphate, read earthy 18. phosphates. 64 1st note, for addition of, read additions to, and for Dr. Gross's, read Dr. Gross' 22 " 19 8th., for analyses, read analysed. 66 66 20 66 17th., inscrt urate of, before magnesia. 64 66 19th., for in the twelve, read in twelve. note for quantity, read quantities. 6 21 22 66 24th., for uniform. Size, read uniform size. 66 22 66 25th., for smaller, read small. 66 66 46 note, for constructed, read contracted, and for fragment, read fragments. 45 # 23 44 13th., for epethelaum, read epithelium. " 24 66 20th., for after treatment, read after-treatment.

INTRODUCTION.

This Report embraces the results of the chemical analysis of one hundred and eighty Urinary Calculi,* constituting the Tennessee Collection. Of this number four were from the lower animals, an account of which will be found in the appendix. The remaining number, of one hundred and seventy six, were from human subjects, and they only will be considered in the body of this paper.

The subjects, from whom these concretions were taken, were mostly residents of this State, many were residents of Georgia, and a few perhaps of the state of Kentucky.

These analyses were not undertaken to answer any special question in animal chemistry, physiology, or aetiology; but simply to bring to view facts existing in our midst, whether they should answer existing questions or propound new ones. And in the performance of this task my chief aim has been, comprehensiveness of plan, accuracy of research, and truthfulness of delineation. The number of analyses, of course precluded the practicability of quantitative determinations, even could one have imagined the probability of results capable of compensating a task as laborious as it would have been endless. Mere traces have not been searched for, nor the presence of new or rare substances—such labor would have been more trivial than useful—the result more curious than instructive.

It will be observed, however, that the anlyses embrace more minuteness of research than is usually found in qualitative examinations of this nature. It has not been the predominating constituents only that have been determined; but in every instance, all of the constituents, within certain limits, have been isolated, and their various associations ascertained. The coloring matter received no special attention.

MODE OF ANALYSIS.

After determining the weight, and in many cases the specific gravity of the calculus, it was sawn as nearly through the geomet-

^{*} Prof. Eve contributed 115; Prof. Buchanan (3; Dr. Estill of Winchester 12; Dr. D, W. Yandell 10; Dr. Overton of Nashville 7; Dr. Avent of Murfreesboro' 5; Dr. Jones of Springfield 3; Dr. T. W. Briggs 3; Dr. House of Clarksville 3; Dr. Debow of Hartsville 2; Prof. Porter 2; Dr. Felix Robertson 1; Dr. Ford of Nashville 1; Dr. R. C. K. Martin of Nashville 1; Dr. Evans of Shelbyville 1; and Dr. Erving of Nashville 1.

rical center as practicable. The dust from the saw being carefully brushed from the surface, the nucleus and each layer (when the appearance indicated a change of material) were submitted to the fol-

lowing process.

1. From one fourth of a grain to one grain was detached with the point of a knife and ground to an impalpable powder in an agate mortar; transferred to a test tube; treated with distilled water; heated to the boiling point over the blaze of a spirit lamp; and filtered whilst hot through sweedish filtering paper—to extract the urates. To the filtrate (A) (if a drop or two evaporated on a slip of glass left a residue) a few drops of hydrochloric acid were added and et in a cool place for future use.

2. The residue (when any) was next treated with dilute acetic acid, raised to the boiling point, filtered when cool, and to the filtrate (B) ammonia was added slightly above neutralization—to extract and determine the phosphate of lime, and the triple phosphate of magnesia and ammonia. When a precipitate appeared these salts were respectively determined by the aid of the micro-

scope.

3. The residue (if any) being washed, first with acetic acid, diluted, and then warm water, was treated with dilute hydrochloric acid raised to the boiling point, filtered when cool, and the filtrate (C) treatwith ammonia, as in the last instance—to extract and determine the presence of Oxalate of lime.

4. The remaining residue (if any,) was next treated (after being washed with water) with dilute solution of potash, filtered, and the filtrate (D) treated with hydrochloric acid to slight acidity—to extract and determine the presence of free uric acid.

The filtrate, (A) after remaining sufficient time for the complete crystalization of the uric acid,* was treated as follows to determine the bases of the urates.

1. After filtration a few drops were placed upon a slip of glass and gently evaporated over the blaze of a spirit lamp. On cooling, it was moistened with a saturated solution of carbonate of soda and

^{*} At Plate 1. Figure 1. are represented the forms of uric acid crystals most usually encountered in this treatment. Those with serrated edges are seen the most often. They sometimes have considerable length, reaching entirely across the field of the microscope. As uric acid assumes such an endless variety of forms under artificial circumstances, I would not have figured these, were it not that they are the forms most invariably assumed under the above circumstances and yet I have seen them figured no where.

a glass rod with a drop of hydrochloric acid upon its end held above it—to determine the presence of ammonia.

2. A drop or two of the filtrate was placed upon a glass slide and allowed to evaporate spontaneously—to determine the presence of sodium, by the appearance under the microscope of the crystals chloride of sodium.

When any doubt arose as to the nature of the crystals they were moistened with a drop of water, and a drop of bichloride of platinum added, and again allowed to evaporate, and the double cloride treated with cold water, which readily dissolves the sodium crystals, but not those of potassium and ammonia.

3. Another portion of the filtrate was placed in a watch crystal, nearly neutralized with ammonia and then treated with oxalate of ammonia—to determine the presence of lime.

After the first twelve analyses, potash not being found at all, and magnesia but once, and then in a small quantity, they were not searched for in subsequent analyses, particularly as the time I allowed myself would not admit of delay upon points of minor interest. Neither will carbonate of lime be found in the table of analyses; because 1st, it was overlooked in many cases and therefore may have existed oftener than my notes indicate, and secondly, the quantity was too small and its occurrence too seldom, to be regarded otherwise than accidental.

The microscope was always used to identify the precipitates, when the slightest doubt arose with regard to them.

I deem it hardly necessary to state that the reagents were pure. They were obtained from E. N. Kent of New York, and their purity tested by myself before they were used.

SOURCES OF FALLACY MOST LIKELY TO BE OVERLOOKED.*

- 1. In extracting the urates with boiling water, if too little water be used, or the matter not well pulverized, a portion of the undissolved urates may pass through the subsequent treatment and appear as a residue that will give the reaction, with potash and hydrochloric acid, of free uric acid. (See Plate 1. Figure 2. and explanation.)
- 2 In determining the presence of ammonia, as a base of uric

^{*} It is hoped that the experienced chemist will excuse the introduction of the remarks under this head as they are not intended for his instruction; but only to aid the inexperienced who may be disposed to pursue the method above laid-down.

acid, if any fumes of ammonia be present in the room a false result

may be given.

3. In determining the presence of soda as a base of uric acid, if after crystallizing as chloride of sodium the glass slide, be left any length of time before examination, moisture from the atmosphere will efface the crystals by partially or wholly dissolving them. Again, as chloride of potassium crystallizes in forms not very unlike chloride of sodium, it may be necessary, particularly with those who are not very familiar with the appearance of these crystals, to use the bichloride of platinum, as stated above, to distinguish them.

In this treatment, the ammonia will also form crystals of double chloride (of plat. and am.) analagous in form with those of sodium and platinum, and therefore the number of crystals may be greatly increased; but the action of cold water determines the sodium crystals by their ready solubility in that menstruum. The larger crystals of the double salt of sodium, however, do not at once dissolve; yet they immediately become dark and lose their bright yellow appearance by transmitted light, whilst those of potassium and ammonia become even more bright and elegant by the immersion.

4. In extracting the phosphates with hot acetic acid, if the residue be not treated with the solvent as long as it will give a precipitate with ammonia, a portion of the phosphates will remain and embarrass the examination for oxalate of lime. An experienced eye however, can generally detect the fallacy, as the triple phosphate appears mostly on the surface, the phosphate of lime light and flocculent, whilst the oxalate of lime falls towards the bottom in a fine dust like powder. The microscope however, should always be used to verify their nature. The inch objective readily displays the crystaline triple phosphate, and amorphous phosphate of lime, whilst it requires the $\frac{1}{4}$ inch objective to define the very small octohedral, but most commonly eliptical, crystals of oxalate of lime.

(See Plate 1. Figure 3 with explanation.)

EXPLANATION OF THE TABLE OF ANALYSES.

The division of a calculus into body and nucleus, is in a good degree arbitrary; for it often happens that even in those calculi formed of concentric layers, the change of substance is so gradual as to form no well marked line of distinction between a body and a nucleus. This structure indeed, is, often seen when there is no appre-

ciable change of substance at all, but only concentric lines from a more highly colored state of the deposit at one time than at another.

In the larger number of specimens, however, as when a nucleus of urates is overlaid by the oxalate of lime, or the phosphates, and vice versa, there is a very well marked line between the two deposits, indicating two very distinct conditions of the fluid from which they were formed. In most cases, the color would seem to indicate the two portions; yet this will not suffice in itself, unless we are willing to regard the nucleus, as we have often to do the body, as containing alternate layers of different chemical constitutions; for I have often seen a dark nucleus, with a whitish body, when the nucleus proper (or rather in the sense in which the term is here used) was found several lines within the line marked by change of color. Thus a nucleus of urates is covered by a layer more or less thick of oxalate of lime, (of like color) over which is a large white body of earthy phosphates. Here the color would seem to divide the calculous into two distinct parts, and vet if such a division be admitted we could have no common understanding as to what constituted a nucleus in contradistinction to a body. These remarks are made because I am not certain that I understand what writers always mean by a nucleus, and as Dr. G. Bird has very sagely suggested the importance of a careful study of the nuclei of calculous formations, I desire no such obscurity to involve these researches.

In this paper then the term nucleus is employed to designate the central part of the calculus formed in the first era, if I may so speak, of urinary deposition—that when there appears an appreciable change in the chemical constitution, another era may be said to have taken place, and this deposit is not included in the nucleus.

With regard to foreign substances, when after being cut by the saw there is left upon both planes of the divided body, a subtance plainly visible to the naked eye, I have in obedience to usage termed them nuclei. But in the examination of very small calculi or gravel, in cleaving them open or scaling off layer after layer to the central point, I do not apply the term nucleus to minute particles of dried blood, or small masses of epithelium scales, or fibrinouscasts that may occupy their centres, because in sawing open large calculi, the exact centers are seldom or never found, and when they are, the saw will carry away such small masses; and thus, uniformity of comparison would be destroyed. Perhaps such little starting

points, might better be termed nucleoli. And yet these smaller masses would seem to deserve as much the title of nuclei, as larger ones, of whatever substance they may consist. Indeed accuracy requires that all stating points, however small, should be termed nuclei, or else that name be applied only to the first urinary deposit—and thus indicate the chemical nature of the urine in the first period of calculous formation,

It will be observed, moreover, in looking over the table of analyses, that in several calculi the bodies and nuclei are noted as chemically identical. In these, the color or physical structure determined the distinction—no confusion, of course, arises from this, since the simplicity of structure of the nucleus is still preserved.

Of course all that covers the nucleus is embraced in the term body whether it consists of one or more layers. In some specimens there existed a thin exterior covering quite different in appearance and chemical nature from the other portions of the body, that seemed to merit some such appellation as cortex or crust; yet no distinction is made in the table, as it would complicate the classifications, without a commensurate advantage.

The table which follows, exhibits the chemical constitution of each calculus. It is arranged for the sake of condensation and simplicity to divide the calculus into nucleus and body, yet in very many cases, two, three, and even four layers were submitted to independent analyses.

The 1st column, in the table, contains the number in the order of analysis; the second column contains the weight of the calculus in grains; the 3d column the specific gravity; the 4th column contains the substance that predominated in the nucleus; the 5th contains substances associated with the predominant constituent of the nucleus; the 6th column contains the predominant constituent of the body; and the 7th column the associating constituents. The triple phosphate of Mag. and ammonia, and phosph. of lime are in italics, when associated in that proportion to form the tusible mixture. The letters against the numbers indicate duplicates.

The number of words occurring in some of the lines of the table required the following abbreviations, viz: Tr. ph., or Trip. phos., for Triple phosphate; Ph. lm., or Phos lime for Phosphate of lime: Ox. lm., or Ox. lime, for Oxalate of lime; and U. a. for unic acid.

Table of Analyses.

9

Table of Analyses, Continued.

											_	_											
70	BODY	Predominant Associated with predominant Constituent.		See	Phoenhate of lime and	Ovalate of lime	Cautate of mile	Trates and phos of lime	and pines of filling	Trates and phos of lime	Trates		Tales			Phos. of lime				Phos. of lime and urates			
Contratance				Phos of Im	Ox. of lime	Urates		Ox. of lime		Ox. of lime	Ux. of lime		Ox. of lime	Phos. of lime	Trip. phos.	Trip. phos.	Phos. of lime	Phos of lime		Trip. phos.			
Outringer.	NUCLEUS	Associated with predominant constituent.	Uric acid	Uric acid and Ox. of lime	Oxalate of lime				Urates and phos. of lime .	•		Phos. of lime and urates				Phos. of lime and urates		Ox. of lime -		Phos. of lime and urates			
		Predominant Constituent.	Urates	Urates	Urates	Urates	Urates	Urates	Urates	Urates	Urates	Ox. of lime	Urates	Urates	Urates	Ox. of lime	Urates	Urates		Trip. phos.			
	iins iins iity	signi signi signi signi signi signi	8	359	98	61 1.526	4	328 1 812	35	305 1.572	53 1.432	901	42	151 1 652	53 1.432	420 1.443	98 1.564	84 1.514	1.675	375		-	=
	.(N	d23	24	25	26	61	628	659	0.3	33	32	33	34	35	36	37	38	139	to 1375	1113	_	=

Table of Analyses, Continued.

-	BODY	'ssociated with predominant Constituent.				Ox of lime and urates		Tr. phos. phos. Im. & urales		Urates	Oxalate of lime	Phos. of lime	Phos. Im. urates & uric acid	Urates	Trip. phos. and phos. of lime	4	Ox.of lime			Tr. phos. Ox. Ir. & urates				
a concrue		Predominant Constituent.				Trin phos.	Trip. phos.	Ox. of 1 me	Urales	Oxalate of lm.	Urates	Trip. phos.	Ox of lime	Uric acid	Ox. of lime		Urates			Phos. of lime	Uraies	Phos, of lime		
The state of the s	NUCLEUS.	Associated with predominant constit. Predominant 'ssociated with predominant ueut. Constituent.		Trip. phos. Phos. lime and urates			Urates				Uric acid	Phos of lime				Phos. of lime		Ox. of lime		Urates	* * *	Phos. of lime and urates		
		Predominant Constituent.		Trip. phos		Urates	Ox. of lime	Urates	Urates	Urates	Urates	Urates	Urates	Urates	Ox. of lime	Ox. of lime	Urates	Phos of lime	Urates	Ox. of lime	Urates	Ox. of lime	Ox of lime	Ox. of lime
	Sity	Spec					1.523	166 1.527	1.567	1.45			205 1.601	1.656	1.687					1.351	1.555	1.236		=
	sid:	gis W erg ni		75		55	1027	-	55	116	74	120		53	147	130	20	11	19	369	182	136	03	91
	.(N	f114	01	[13]	132	133	134	135	136	g137	g 138	139	140	141	142	143	144	145	146	147	148	h149	h150

Table of Analyses, Continued.

BODY.	Associated with predominant Constituent.					Trip. phos. & phos. lime	Trip. phos. and urates			Phos. Im. trip, ph. and urates		:	Phos. lime and urates	Trip. phos.			Phos. of lime	:	Phos. Im. Ox. lime & urates	
	Predominani Constituent.					Ox. of lime	Phos. of lime		Phos. of lime	Ox. of lime			Triple phos.	Urates		Triple phos.	Urates		Triple phos.	Ox. of lime
NUCLEUS.	Associated with predominant constituent							Triple Phos. and urates	Oxalate of lime		Phos. lime. Ox. lime and urates			0 0		0				
	Predominant Constituent.	Ox. of lime	Ox. of lime	Ox. of lime	Ox. of lime	Urates	Urates	Phos. of lm.	Urates	Urates	Trip. phos.	Urates	Urates		Ox. of lime	Urates	Urates	Ox. of lime	Urates	Blood*
ins	Weigh in gra Specif Gravi	62	83	63	2	85 1.760	50	80 1.198	235 1.597	460 1.603	406	4	450	272 1.710	63	236 1.210	488	10	248	146
	ON IgisW	h151	h152	h153	h154	155	156	157		159	160	191	162	163	164			167	168	169

burnt seathers—ether extracts a brownish sat - boiled in nitric acid, serrocyanide of potasisum gives the reaction of iron—digested in aq-potass and neutralized with acetic acid, a light brown slocculent precipitate is obtained—boiled in acetic acid, serrocyanide of potasium *A dark brown substance of low specific gravity - fuses and burns rapidly before the blow pipe, exhaling a dense smoke of the odor of hrows down a dirty whitish precipitate.

Table of Analyses, Continued

BODY.	Associated with predominant Constituent.					Ox. or time and phos. time	Ux. of time and Urales	Urales
	Predominant Constituent					Trip. phos.	Trip. phos.	Ox. of lime
NUCLEUS	redominant Associated with predominant constit. Predominant Associated with predocustituent.	Urates	Urates	Urates	Urates		Ox. of lime · · · ·	Ox. of lime
	r'redominant Constituent.	Uric acid	Uric acid	Uric acid	Uric acid	Urates	175 400 1.540 Urates	Urates
y y	Specifi Gravit					1.617	1.540	
sui	Werg in grai	4	3	63	2	174 631	400	115
1	ON ON	1170	1171	1172	1173	174	175	176

CLASSIFICATION OF THE MATTER OF THE TABLE.

WEIGHTS, AND SPECIFIC GRAVITY.

On looking down the column of weights, it will be observed that the calculi ranged from two grains to one thousand and twenty seven grains. The aggregate weight is found by calculation to be 16029 grains, and the average that of 91 grains.

The specific gravity of 45 only was taken, the lowest result being 1.193, and the highest 1.812, with an average of 1.509.

Of this number (45) with an average specific gravity of 1.509 there were.

SOLO MES	C ₁							
Calculi	of earthy phosphates*	9. wi	th av	erage	sp.	gr.	of	1.338
6.6	of urates*	5,	6.6	6.6	6.6	6.6		1.604
66	of Oxalate of lime*	1,	64	66	6.6	4.6		1.687
4.6	of mixed constitution	† 30.	6.6	66	6.6	66	,	1.533

CHEMICAL RESULTS.

1st of the nuclei.

Whole number of calculi analyses 176. There were 107 duplicates.—176—107.

I. NUMBER IN WHICH THE URATES PREDOMINATE	D	
IN NUCLEI 48 3 duplicates.		45
1. Number of nuclei entirely urates	33	
2. Number having associated with the urates.		
uric acid alone 6-2-	4	
3. Number having associated with the urates,		
Oxalate of lime alone	5	
4. Number having associated with the urates,		
phosphate of lime alone	1	
5. Number having associated with the urates		
phos. of lime, and triple phos.	1	
6, Number having associated with the urates,		
uric acid and oxalate of lime	1	
	45	

^{*} Those having this constituent to predominate in both body and nucleus.

[†]Having different constituents to predominate in body and nucleus.

^{\$}I use the term urates instead of urate of ammonia because I have never found urate of ammonia alone, but always associated with urate of lime, or urate of soda or with both.

II. Number in which Oxalate of lime	PRE-	
DOMINATED IN THE NUCLEI 20-6		14
1. Number consisting entirely of Oxal OF LIME 10-5	LATE 5	
2. Number having associated with the Ox. of lime, the urates alone	2	
3. Number having associated with the Ox. of lime, phos., of lime alone	1	
4. Number having associated with the		
Ox. of lime, the urates and uric acid 2-1 5. Number having associated with the Ox. of	1	
lm., the trip. phos., phos. of lm., urates & U 6. Number having associated with the Ox. of	a. 1	
lime, the urates and phos. of lime	4	
	14	
III. Number in which the Triple phosi	PHATE	
PREDOMINATED IN THE NUCLEI 101-95	,	6
1. Number having associated with the triple phos., phos of lime alone	2	
2. Number having associated with the triple phos., the urates alone, 3-2	1	
3. Number having associated with the trp. phos., phos lime, and urates, 95-92	3	
	6	
IV. Number in which Phos. of Lime Ph	REDOMI-	
NATED IN THE NUCLEI,		2
Number having associated with the phosphate of lime, Ox. of lime alone	1	
2. Number having associated with the phos. lime, the trip. phos., and urates	. 1	
	2	

V. Number in which Uric acid prede	OMINATED
IN THE NUCLEI 4-3	1
1. Number having associated with	
Uric acid, the urates alone 4-3	1
VI. NUMBER IN WHICH FOREIGN MA	
DOMINATED IN THE NUCLEI	1
1. Number with foreign matter (blood) alone	1
	69
2D OF THE BODIES.	
The number of simple calculi, or nuclei with	out bodies, if I may
so term them, were 44	
The number of compound Calculi, or those h	
a body upon a nucleus were 132-78 duplicates	54
I. Number in which the urates prei	DOMINATED
IN THE BODIES.	. 8
1. Number having associated with the urates	,
Oxalate of lime alone	4
2. Number having associated with the	
urates, the phos. of lime alone 3. Number having sssociated with the	. 2
urates, the trip. phos. alone	1
4. Number having associated with the	1
urates, Ox. of lime, and phos. of lime	1
	8
	-
II. Nueber of bodies in which the	
PHOSPHATE PREDOMINATED 93-78	5 18
1. Number composed of trip. phos. alone	1
2. Number having associated with the	
trip. phos. phos. of lime alone	3
3. Number having associated with the	
trip. phos. phos. lime and urates 83-75	8

 Number having associated with the trip. phos., Ox. of lime and urates Number having associated with the trip. phos., phos. lm., Ox. lm., & urates Number having associated with the trip. phos., Ox. of lime and phos. lime III. Number of eddies in which Oxalate	3 2 1 18	
OF LIME PREDOMINATED		15
 Number consisting of Ox. of lime alone Number having associated with the 	1	
Ox. of lime, the urates alone 3. Number having associated with the Oxalate of lime, the urates & phos. lime	3	
4. Number having associated with the Ox. of lime, phos. of lime, and trip. phos.	3	
5. Number having associated with the Ox. lm., phos. of lime, trip. phos., and urate	es 2	
6. Number having associated with the Ox. of lm., phos. of lm., urates & uric acid	1	
	15	
IV. Number of bodies in which phose phate of lime predominated 15-3		12
 Number having associated with the phos. of lime, the trip. phos. alone Number having associated with the 	1	
phos. of lm., the trip phos. & urates 9-3 3. Number having associated with the	6	
phos. lime, Ox. of lime. and urates 4: Number having associated with the	3	
phos. of lm., trip. phos., Ox, of lm. & urates		
·	12	
V. Number of bodies in which uric acid predominated		1
TOTO TIPDOTITUTED		54

The printer apologizes for the hiatus on next page. This page was in-advertently left out of the form after being set, and had to be printed separately and inserted.



1. Number having associated with uric acid the urates alone

3D, OF NUCLEI AND BODIES.

The compound calculi, or those having a body and nucleus, may be arranged as follows, with regard to the chemical relation of the nuclei and bodies.

Whole number			54
I. NUMBER OF URATE BODIES (HAVING URATES			
TO PREDOMINATE,)		8	
1. Number of these having urate nuclei		8	
II. NUMBER OF TRIP. PHOS. BODIES, 93-75			18
1, Number having trip. phos., nuclei 76-75	1		
2. Number having urate nuclei	12		
3. Number having Ox. of lime nuclei	5		
	7.0		
	18		
III. NUMBER OF PHOS. LIME BODIES, 14-2			12
1. Number having nuclei of urates	7		
2. Number having trip. phos. nuclei, 4-2	2		
3. Number having Ox, of lime nuclei	3		
	10		
	12		
IV. NUMBER OF OX. OF LIME BODIES			15
1. Number having Ox. of lime nuclei	2		
2. Number having nuclei of urates	12		
3. Number having foreign matter (blood) nuclei	1		
	15		
V. Number of uric acid bodies			1
1. Number having nuclei of urates	1		

It will be observed that I have in the above classifications subtracted the duplicates. This is absolutely necessary to obtain truthful results as will readily appear by the following comparison of results by Dr. Peter and myself,* (with regard to the relative number of nuclei of free uric acid, and earthy phosphate,) both with and without subtracting the duplicates.

1

[&]quot;As Dr. Peter's analyses embrace the Transylvania collection, our reserches may be regarded as extending overpretty much the same region of country.

106 1. Whole number analysed by Dr. Peter* Nuclei nearly all uric acid 36 earthy phosphate 8 176 Whole number analysed by me Nuclei in which uric acid predominated "earthy phosphate 103 Thus showing quite opposing results. On subtracting the duplicates, however, the following harmonious results are found, 2. Whole number analysed by Dr. P. 106-35 duplicates-71 Nuclei nearly all uric acid 36-30 duplicates-6 earthy phosphates Whole number by me 176-107 69

Nuclei in which uric acid predom. 4-3 duplicates

I would not have thought it necessary to call attention to a procedure so obviously proper, had not Dr Bird in the 3d edition of his most excellent work on urinary deposits, in making an abstract of Prof, Peter's paper, omitted (inadvertently no doubt) to designate the duplicates of free uric acid nuclei, and in this manner presented his European readers an incorrect idea of the chemical nature of the urinary calculi of this country. Indeed, I had not seen Dr. Peter's paper, until my anlyses were nearly completed, and relying upon Dr. Bird's abstract of his result, I was much surprised in my examination to find the uric acid deposits so rare. It was, truly, to consult Dr. P's mode of analysis, that seemed to give results so different from those I obtained, that led me to apply to that courteous gentleman for his original publication.

COMMENTS UPON THE TABLE.

I shall embrace, under this head only a few remarks upon the comparative infrequency of the appearance of free uric acid.

All British and Continental writers of my acquaintance, speak of uric acid calculi as the most comon variety,† and their analyses

^{*}I quote from Dr. Gross's Report on Ky. Surg., which contains some addition of Dr. P's. original publication.

 $[\]mathfrak{f}$ "The lithic acid is the most common species of calculus." Prout on Stom. and Ren. Dis. p. 445

[&]quot;This (uric acid) is the most common of all the urinary calculi." Bowman's Med. Chem. p. 130

[&]quot;I now proceed to the consideration of the most common urinary calculi." (uric acid) Simon, Chem. of man p. 627

[&]quot;Il [Uric acid] forme a lui seul le plus grand nombre de celles-ci. [Uri-

seem to bear them out in this declaration;* but it will be seen that out of one hundred and seventy six calculi here tabulated, that free uric acid appeared as the predominant constituent in only four.

The aggregate weight of these four calculi is found to be but eleven grains. Cne other calculus, with a large nucleus of urates, has a body of uric acid. This calculus weighs but fifty three grains. In all, five uric acid calculi from two subjects—weighing together only sixty-four grains, whilst the aggregate weight of all analyses, is sixteen thousand and twenty-nine. It will be further observed on looking over the table of analyses, that free uric acid appears but sixteen times, inclusive, even of its presence in smaller quantities with other constituents, and yet my analyses were made in a manner to extract any appreciable quantity of this substance.

It has been already incidentally noticed that Dr. Peter obtained similar results in the analysis of the Transylvania collection. His analysis however, shows a larger proportion of uric acid than mine. Taking uric acid together with the urates, and the results I obtained as well as those of Dr. Peter, do not materially differ from those

obtained in Europe.

I will further remark, that these results closely correspond with my observations upon the urine. For a number of years, I have paid much attention to that secretion in disease, and it has been extremely rare that I have found a doposit of free uric acid, whilst deposits of the urates have been quite common.

To what extent this peculiarity in the urinary deposits exists in the United States—whether it be confined to the Mississippi valley, or to particular geological districts; or whether it be more general; as yet, I have no means of determining; I am ignorant of any extensive analyses capable of enlightening upon this point. It would be interesting to see facts further developed upon this subject.

It may be expected that I will here offer some hypothesis to account for this difference in the chemical constitution of the calculi of this country and Europe. I especially refrain from such speculations, as it is my object only to present facts with such pertinent remarks, as their elucidation may seem to demand. Besides, the data are yet so few. and the subject surrounded by so many intri-

nary concretions.] Sur 109 graviers, MM. Lacanu et Legalas en ont trove 76 d'acide urique presque pur.' MM. Robin et Verdeil. Traite de Chim. Anatum, et Phys. &c., vol. 2, p. 392. And many others might be quoted.

^{*} According to the collation of Dr. Peter, the proportion of uric acid nuclei in Europe is about 51 per cent.

cate questions involving the laws of vitality in health and disease, the hope of success is not of a degree to inspire the undertaking.

FACTS NOT EMBRACED IN THE TABLE OF ANALYSES.

1. Of the bases of the urates. Besides the results embraced in the table, I made eighty four analyses of the urates to determine the bases of these deposits, with the following results.

Ammonia was found in 84. Lime was associated with ammonia in 83. Soda was associated with the ammonia and lime in 55, and soda was associated with ammonia alone in 1.

As a very constant result the ammonia largely predominated over both of the other constituents. The lime was not only more constantly found, but generally existed in larger quantities than the soda.

Since completing these analyses, I find it stated in the, learned work of MM. Robin and Verdeilt upon the authority of Drs. Bigelow and Smith, that contrary to what has been generally thought, magnesia is quite common in urinary calculi.

It may be proper here to state, that notwithstanding I found the urate of magnesia but once in the twelve analyses of the urates, and therefore ceased to regard it subsequently; yet my researches, can by no means be taken as decisive against the frequent presence of this salt in calculi, even of this country—further trials may have greatly changed my results.

It has generally been thought that lime exists very rarely in visical and renal calculi, as a urate; but its presence is seen to be almost as constant in those submitted to analysis by me, as that of ammonia.

I am not prepared to say that the very constant presence of urate of lime, as an associate of urate of ammonia, is peculiar to the calculi of this country, or rather those examined by myself, since I have seen no researches of any extent directed to this point; although authors speak of its infrequency with no little degree of confidence.

2. Animal matter. Using as I did the microscope constantly in my investigations, the physical condition of the animal matter in the calculi analysed, could not entirely escape observation.

Although the time I allowed myself did not admit of so full an in-

^{*} Of course my mode of analysis cannot claim precision with regard to relative quantity in every case—nor can any qualitative method.

[†]Traite de Chimie, &c., Vol 2, p. 438.

vestigation of this subject as was desirable; yet the few results obtained, I trust will not be wholly void of interest.

On pulverizing the matter of a calculus and partially dissolving the powder with its appropriate solvent—hot water for the urates, hydrochloric acid for the phosphate and Oxalate of lime &c.—and placing a drop of this matter under the micrscope, the particles of broken down calculus seemed enveloped by a pelicle of translucent animal matter more or less colored. (See plate 1, fig. 2 a. b, & d) And when the salts were completely dissolved out many of these little films might have been mistaken, by the inexperienced, for epihelical scales, (as seen at c.) The size of these bodies was of course dependant upon the degree of pulverization of the matter, and their form, always that of the original fragment, accidental and varied. These appearances, show conclusively, as has already been announced by MM. Robin & Verdeil,* a very intimate union between the animal matter and the salts of urinary calculi.

Some of these fragments presented another appearance perhaps not unworthy of mention; that of *lamination* of structure. The urates presented the appearance often as seen at a, and the oxalate of lime, when presenting a structure always had the appearance of d.

These markings no doubt show the extreme limits of calculous lamination, and correspond perhaps, with diurnal depositions.

Circulating with these fragments, occasionally were seen little bodies of regular form and uniform. Size (e, Pl. I Fig 1.) I have only observed these regularly shaped bodies in the powder of the urates. On one occasion whilst examining a portion of crushed matter of a calculus of urates & uric acid, after being partially acted upon by hot water and placed under the microscope, a drop of liq. potass. was introduced under the glass cover, a large fragment was seen to break up into a number of these beautiful little calculi? On continuing the treatment with liq. potass., they in turn disappeared leaving a transparent circular disc, which also vanished after a short time. This behavior suggested the probability that the little bodies themselves were formed of the urates, whilst the intervening matter was free uric acid—as the liq. potass would act more energetically upon the free acid.

Besides the matter already noticed, epithelial debris, as well as fibrinous casts of the kidney tubes, and a structureless fibrinoid matter were now and then recognised. These latter, however,

^{*}Traite de chimie, &c vol. 3, p. 489,

were found more constantly, and in larger masses in the central portion of the concretions.

I examined five specimens with special regard to this point. In order to do so very small calculi were selected. (Or the smaller nuclei of larger ones, that sometimes become detached and roll out whilst sawing them open.) They were carefully reduced by scaling off layer after layer, down to a small central mass.* This, after treatment more or less prolonged, with boiling water, didute hydrochloric acid, and dilute solution of caustic potash, and lastly sulphuric ether, was washed with distilled water, teased out with needles (and generally retreated as above, as the deposited matter adheres with great tenacity,) and placed under the microscope.

I have invariably found this central portion, to consist, in a large proportion, of animal matter, sometimes friable and easily broken up, but oftener tough and adherent, displaying when well prepared, masses of epithelium scales, fibrinous casts from the tubes of the kidney, and a fibrinous looking substance without definite structure.

Besides the little bodies just noticed, six small oxalate of lime (hemp seed) calculi † were opened and the centres of all six (from the same subject) were occupied by a dark brown pulverulent matter giving the reaction of blood as noticed already.

All of these central masses would have escaped detection, had the calculi been of sufficient size to have required the saw to open them.

Origin of Urinary Calculi.—However averse I may be to speculate upon the results of the very limited researches here recorded; the facts just mentioned are so suggestive, I trust it will not be considered out of place should I offer a few remarks upon the origin of urinary calculi.

It is, if I mistake not, generally believed, that some general or

^{*} Many were experimented upon, but five were all that could be sufficiently reduced for satisfactory examination. Indeed most calculi becomes so compact towards the centre as to render their concentric reduction, almost or quite impossible. After being reduced as far as practicable, by splitting them open with the point of a knife the nucleolus (?) may be found, (sometimes as large as a bird shot) so constructed, as to be easily detached entire. It is best to immerse the little stone in water before attempting to split it in order to prevent the fragment from flying off.

[†] Nos. 149, 150, 151, 152, 153, and 154, of the Table.

constitutional cause, such as peculiarities of food and drink, functional disorders—in short, everything that may give rise to a morbid urine—operates to give origin to urinary calculi, and that the great majority of these bodies are indebted for their origin to such general causes, whilst a very few proceed from local ones—that the former constitutes the rule, and the latter the exception.

From facts already recorded, with a few other reasons to be offered, I am led to believe that the reverse of this is true. That a very few, if any are indebted for their origin to general causes, whilst the great majority arise from local ones—that the latter constitutes the law, and the former the exception.

I presume it can hardly be doubted but that the little masses of animal matter—in the form epetheleum debris, fibrinous and perhaps albuminous exudation, and drops of blood, noticed above—acted as the potential causes of the formation of the concretions in which they were found. And as these were all that were satisfactorily submitted to examination, it would not be unreasonable to presume that at least a majority of the rest would have presented the same central structure, could they have been treated and examined in the same way. Nor is it at all necessary to conclude that the urine must have been abnormal in its chemical constitution, or that it held a sediment in suspension in order for these bodies to become nuclei of deposit; for it is well known that any foreign substance lodged in the urinary passages, quickly provokes a precipitation from the urine, however healthy that fluid may be.

Of course the comparatively few examinations made cannot claim to settle the point, even of the constant presence of animal matter in the centres of calculi. All that can be here claimed as established is, that the number of calculi indebted for their origin to foreign* substances—to local instead of general causes—is far greater than is generally believed. A few calculi of earthy phosphates, without concentric structure, soft and friable in their texture, seem to be mere aggregations of sediments already existing in the urine. With these few exceptions it is quite probable to my mind, that all are in like manner due to a local origin; and for the following additional reasons.

First: It is contrary to my experience, and I presume to that of others, that those who suffer from urinary deposit, show any special tendency to calculous troubles.

^{*} Foreign to the urine in a chemical sense is what is meant here by this term

Individuals will for years discharge urine giving rise to abundant deposition, and yet never pass gravel, or give signs of stone. In deed it is well known to those who pay attention to the urine in disease, that there is scarcely an individual who labors under disorders of the assimilating functions but present a morbid state of the urine giving rise to deposit; and yet a case of stone is rarely met with whose origin is dated at that period of life most fruitful of such disorders. And on the other hand, according to my experience, (which is comparatively limited, however,) the urine of persons afflicted with stone is found generally quite free from deposit, except where the calculus has caused much irritation of the bladder, or the general health has become impaired by long and painful suffering.

Secondly: Another consideration which supports this view is, the general freedom from recurrence of calculi, after successful operations of extraction. I have made some enquiries upon this point, and find that where there has been no reasons to suspect disease of the kidney, a recurrence of stone has been quite rare. I believe, without knowing however, that this is the experience of surgeons every where. Now as surgeons trouble themselves but little about the chemical state of the urine, and therefore rational after treatment being seldom instituted to correct the diethesis, it is quite conclusive that if a constitutional cause existed they would be most certain to recur.

After a stone has commenced forming, that a urine loaded with substances of limited solubility, will cause the calculus to enlarge more rapidly—and that such a urine may even predispose to deposition upon nuclei that might be washed away by a healthy urine—will not be denied. I wish only to show by the foregoing remarks, that without a nucleus of foreign matter no state of the urine (with the few exceptions mentioned,) will likely give origin to a calculus, and that where there is such a nucleus any state of the urine may form one.—And, that the facts above recorded point to the kidney and the agents that determine its local pathology rather than to the urine and those agents that modify its chemical nature, as the chief sources of urinary calculi.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1.—Magnified 110 diameters.—Crystals of uric acid obtained by treating the hot filtered solution of the urates with an excess of hydrochloric acid.

Fig. 2.—Magnified 205 diameters.—a, b, c, and d, are fragments of powdered calculous matter that have been subjected, more or less, to the action of solvents. a, and b are fragments of urates as seen after slight treatment with hot water. The translucent edges show the web of animal matter after partial solution of the salts, whilst c, shows it after more complete solution. a, also exhibits the delicate laminated structure often presented by the urates. d, portrays a fragment of oxalate of lime after slight treatment with dilute hydrochloric acid. e, little bodies resulting from the breaking down of a fragment of calculus of urates and uric acid, by treatment with ag. potass.

Fig. 3.—a, magnified 205 diameters, and b. 425.—Crystals of oxalate of lime, most constantly encountered in examining the precipitate formed in the treatment which reduces the urate of lime to a chloride and then to the oxalate of lime; also when the hydrochloric acid solution of oxalate of lime is treated with ammonia. They are most always in clusters as represented in the drawing, whilst a few isolated octahedral crystals are scattered amongst them. Similar bodies are found figured in most all works on urinary deposits, as occurring in the urine.

PLATE II.

A mulberry calculus (natural size) from the bladder of a hog.

APPENDIX.

Calculi from the lower Animals.

No. 1. From the bladder of a hog, and presented me by Dr. D. W. Yandell—weight five ounces and eleven grains—specific gravity 1.908—composed of oxalate of lime, carbonate of lime, and phosphate of lime. The oxalate of lime greatly predominating constituting it a true mulberry calculus, and as far as I know the largest of this variety upon record. The same chemical constitution existed throughout its structure. Figured at Plate II.

No. 2. From the bladder of a horse, and sent me by 1)r. Estill, of Winchester—weight 865 grains—specific gravity 2,101—composition, carbonate of lime with a small proportion of phosphate of lime. This is a very interesting calculus—oblong and smooth upon its surface, of pure whiteness, and almost as hard as the hardest bone, receiving a smooth polish, and has for a nucleus a section of a twig of one line in diameter. I can imagine but one way in which this bit of a twig found access to the bladder, viz: from the intestine by ulceration. I received no history of the animal.

No. 3. Sent me by Dr. Avent, of Murfreesboro'—from the bladder of a hog—weight 125 grains—nucleus a dried clot of blood, loose—body composed of exalete of lime with a small proportion of carbonate of lime—surface beautifully tuberculated.

No. 4. Presented me by Prof. Buchanan, of Nashville—from the bladder of a hog—weight 109 grains—nucleus of blood, large and loose—body, a hard shell but little thicker than the shell of an egg, and composed of carbonate of lime.









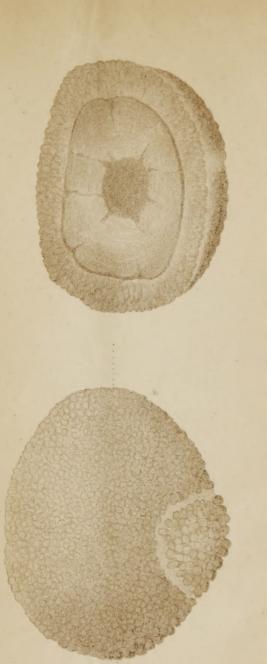
Fig. 2.





Fig 3





" S. Dunde S. C. Strates and proper Pare





